Lawns

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Lawns

By GEORGE M. MCCLURE, C. J. WILLARD, and F. A. WELTON

Establishing a New Lawn

Grading.—Every lawn has at least two fixed grade points; the grade line of the house and that of the curb, sidewalk, or roadway. Some lawns may have other fixed grade points, such as trees, which cannot be altered. The first step in the constuction of a new lawn is the establishment of a suitable grade for the ground surface between these fixed grade points. The general contour as finally established should be not only pleasing to the eye, but also should be so sloped as to lead surface water away from the house and off the property. Terraces, or abrupt changes in slope, should be avoided if possible, for they are not only difficult to build but also tend to dry out during periods of hot dry weather, with consequent injury to the turf.

In order to gain a clear idea of the appearance of the finished contour, it is advisable to set grade stakes at various intermediate points between the fixed grade points. This should be done only after the ground is plowed and the rough grading done. It should also follow the laying of drain tile, if drainage is deemed necessary. These stakes may be set at definite distances apart—20 to 50 feet—over the lawn area. After setting, they are connected by strings stretched tightly between the stakes. The line thus formed is viewed from some distance away, and raised or lowered on the stakes until it has the desired slope. After the slope of the network of lines has been satisfactorily adjusted, the height on each stake is marked and the lines removed. A desirable grade may be established in this way without the use of surveyor's instruments. When this is done, the next step is to make the surface of the soil over the entire lawn conform to the established grade, as described later.

Drainage.—If the subsoil is clayey and impervious in nature, as is the case with many soils over the state, tile drainage will be of benefit. It not only will make wet, soggy places drier, but will aid in quickly removing the excess water due to heavy rains, and so help in aerating the soil. Ordinary 4-inch drain tile, laid in lines 15 to 25 feet apart, and 2 to 2½ feet deep, with a fall of 4 to 6 inches in every 100 feet, are suggested where drainage is needed.

On city lots, difficulty is often experienced in obtaining an adequate outlet for the tile lines. If there is a decided slope from

Contribution from the Departments of Soils and Farm Crops, The Ohio State University, Columbus, and the Department of Agronomy, Ohio Agricultural Experiment Station, Wooster.

the house to the street the lines may be carried underneath the sidewalk and allowed to empty into the street. In other cases they may be connected with the storm sewers.

Preparation of Soil.—The requisites of a soil suitable for the growth of turf are good drainage, proper physical condition, sufficient depth to allow for root development, and an adequate but not excessive amount of organic matter. Drainage has a favorable effect on the physical condition of soils and also permits deeper root growth. The poor quality of many lawns is due to poor soil from the cellar excavation. It is almost impossible to produce a satisfactory turf on such heavy, clayey soils. In case the establishment of the lawn is considered before building operations are begun, the top soil should be removed and set aside, to be used later during the final grading. If this is not possible, enough good surface soil, neither too sandy nor too clayey in character, should be provided to cover the soil from the cellar excavation to a depth of from 2 to 4 inches.

If the soil available is at all clayey, it can be improved by the addition of some organic material. Liberal applications of manure may be thoroughly incorporated with the upper 3 to 4 inches of such soils at least one month prior to seeding; 1 to 1½ tons, or 2 to 3 cubic yards per 1000 square feet, is suggested. Well rotted manure is preferable. The only objections to the use of manure are that it may contain weed seeds, and, in the city, that it is difficult to obtain. The weed seeds in manure will not prove serious if the manure is applied several weeks before seeding time, for most of them will germinate so that the young plants will be killed during the final preparation of the seedbed.

If manure is not available, or if the lawn area is so large as to make the cost of manure prohibitive, recourse may be had to a "cover crop" to supply the needed organic matter. Such crops are especially advantageous when the lawn area is ready for grading in the spring. Soybeans may be sown at the rate of 2 bushels per acre during the latter part of May or early in June, and plowed or spaded under about the first of August, while still green and succulent. Buckwheat may be similarly used on heavy clay soils. The ground is then cultivated at 10-day intervals until the final preparation of the seedbed just prior to seeding. The amount of organic material furnished by a cover crop may be increased by applying 15 to 20 pounds per 1000 square feet of area of a fertilizer such as a 4-12-4, prior to seeding. Soybean seed should be inoculated.

Peat and muck are sometimes used to improve the physical condition of heavy clay soils. These materials have little or no

fertilizing value, as they consist largely of very inert organic materials that decompose only slowly in the soil. The cost of such materials is usually high. An application of at least ½ ton of peat per 1000 square feet is required to increase the organic matter content of the surface 4 inches of soil by 4 per cent. The present cost of this material varies from $15 to $40 per ton.

Occasionally the commercial peats contain as much as 40 per cent of water. High moisture content enormously increases the

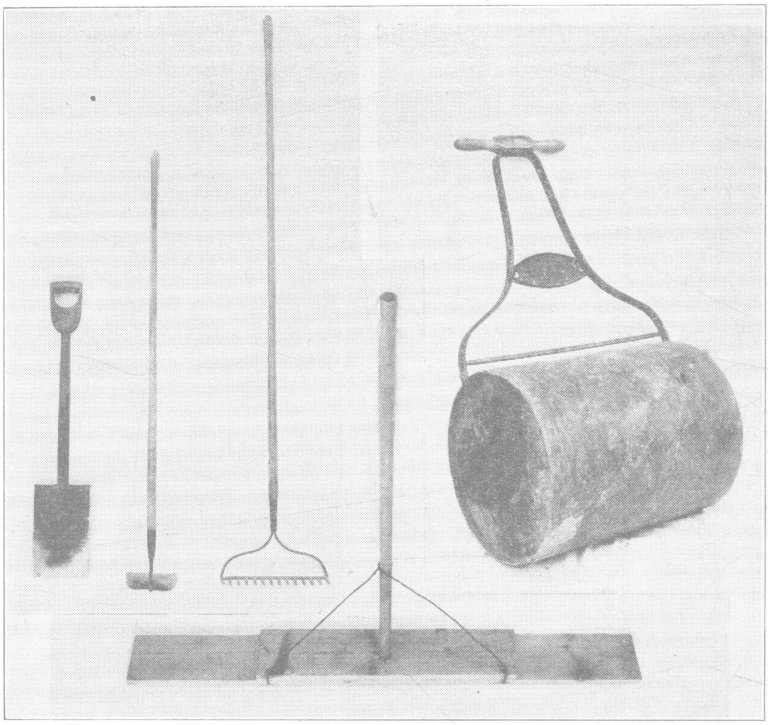


Fig. 1.—Tools useful in starting the lawn.

cost of the actual organic matter. Such peats are preferably purchased by the cubic yard, rather than by the ton. The use of extremely acid peats should be avoided as they often prove toxic to turf. If either peat or muck is used, it should be intimately mixed with the upper 4 inches of soil, and the formation of definite layers avoided.

The final preparation of the area prior to seeding will consist in removing all debris, such as stones and waste materials left from the building operations, and then bringing the level of the ground

to the previously determined grade, preferably by using good top soil for at least the top two or three inches. The area should then be hand raked to remove stones and clods and to smooth out unevennesses of the surface. After raking, the area should be rolled with a fairly heavy roller to crush clods, firm the soil, and indicate low spots not evident before the rolling.

Following this rolling the fertilizer should be applied, then the soil should be thoroughly stirred up to a depth of 2 inches by raking. This final raking should leave the surface in a fine, mellow, smooth condition. To do the final smoothing it is often convenient to use a rigid, straight edged board (Fig. 1) fitted with a long handle equidistant from either end and made rigid by braces. The board is pulled with a shearing motion across the surface, thus scraping off the high spots and dropping the soil into the depressions.

Fertilization.—Even though manure has been applied previously, the addition of from 10 to 15 pounds per 1000 square feet of a high grade commercial fertilizer having a 4-12-4 or similar analysis, will prove beneficial. If manure has not been used, the amount of fertilizer should be increased to 20 to 25 pounds per 1000 square feet.

All fertilizer should be spread evenly over the soil prior to the final raking of the seedbed. Spreading by hand is satisfactory, provided sufficient care is used to apply the material evenly. Too large quantities of fertilizer in one spot may affect seed germination. A uniform spread by hand may be obtained by dividing the area into smaller areas of 250 or 500 square feet, weighing out the proper quantity of fertilizer for each small area, and applying it to each of the smaller plots separately.

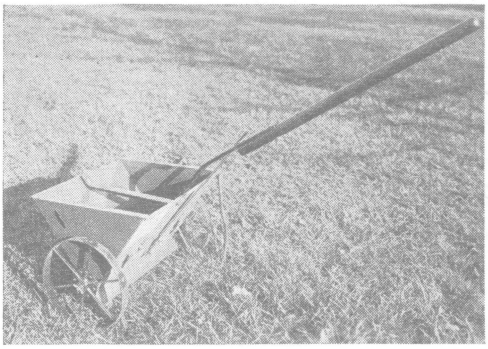


Fig. 2.—Small, practical fertilizer distributor for lawn.

Several small fertilizer distributors adapted for applying fertilizers to lawns are on the market. In many cities it is possible to rent these from hardware stores at a reasonable cost. The use of such machines will insure that the fertilizer is applied evenly and in the right amount.

Use of Liming Materials.—The purpose of adding lime or limestone to a soil is to decrease soil acidity. The growth of both grasses

and weeds is influenced by soil reaction. Some thrive best on acid, some on neutral, and some on alkaline soils, while some grow well over a wide range of soil reaction. Fortunately, the more important lawn grasses thrive well on moderately acid soils, at reactions that tend to discourage some of the more troublesome weeds. For this reason it is usually a mistake to apply lime to lawn soils.

On highly acid soils, some lime should be added, or else seed of the more acid-tolerant grasses, such as the bents or fescues, should be sown. Before applying any lime, a determination of the reaction of the soil should be made. Such a determination, with a recommendation as to the amount of lime needed, may be obtained free of charge by sending a sample of the soil to the Department of Soils, Ohio State University, Columbus, Ohio.

Sodding.—If an immediate effect is wanted, sodding is desirable. If the time element need not be considered, seeding is to be preferred both because of its lower cost, and because less difficulty is usually experienced in obtaining a weed-free sod. It is usually advisable to sod steep terraces, where washing would prevent the establishment of a turf from seed. It is also frequently desirable to sod areas which are subject to more or less constant abuse, such as areas between the walk and curb, and areas on which children play.

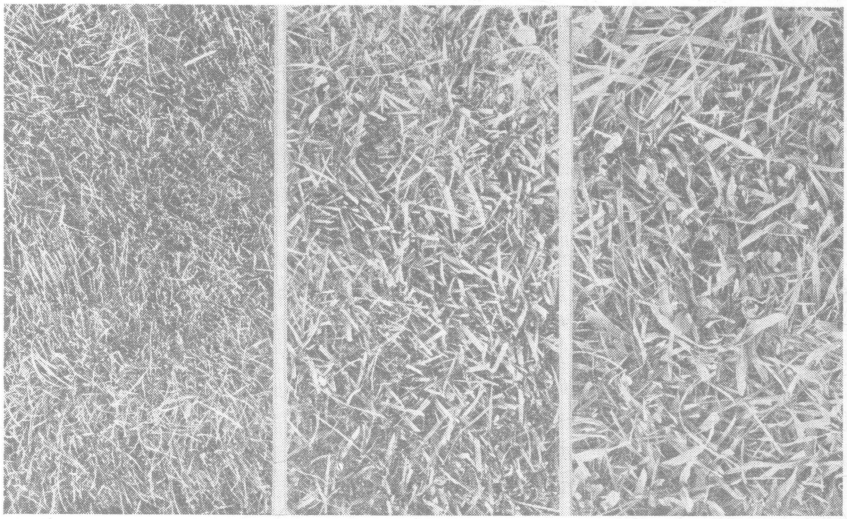
If sodding seems desirable, the soil should be given the same preparation as that already recommended for seeding. It should contain adequate amounts of manure or other organic materials, and should be thoroughly drained, pulverized, and liberally fertilized. To cover hard unfertile soil with sod, no matter how good the sod, is certain eventually to end in failure. Sodding shady places where grass has failed is often recommended, but the cause of the failure of the grass will eventually result also in the failure of the sod.

The sod should be cut to uniform thickness—¾ to 1 inch—and laid so that the joints are even, without openings between them. After laying it should be thoroughly watered, and then either tamped, or rolled with a medium weight roller. If so laid on a good seedbed, it will send roots into the soil in three or four days, and will be firmly knitted to the soil in two weeks. The subsequent maintenance should be the same as that for an established lawn.

Suitable Lawn Mixtures.—The foundation of most Ohio lawns is Kentucky bluegrass, called June grass in some sections. Since it starts rather slowly, various other quicker-starting grasses are usually sown with it. Probably the best all-around mixture is Kentucky bluegrass 75 per cent, Redtop 25 per cent. This should be

sown at the rate of at least 3 pounds to 1000 square feet—4 pounds is better for quick growth. Most commercial lawn mixtures will contain 10 to 20 per cent of timothy or ryegrass, or both, in addition to the above. These grasses make a cover quicker than the bluegrass-redtop mixture, but are coarser and less desirable later.

White clover may be added to any grass mixture to the extent of 5 per cent, if desired. If the lawn is going to be neglected and left more or less to shift for itself, some white clover is probably desirable, but a better-looking lawn can be produced without it if the lawn is given proper care.



Chewing's fescue | 80 per cent bluegrass
20 per cent red top | 80 per cent bluegrass
20 per cent timothy

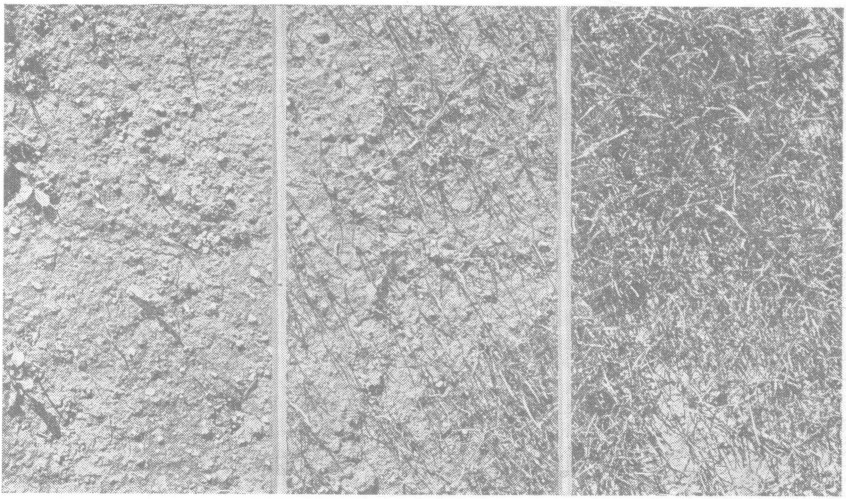
Fig. 3.—Illustration shows wide variation in lawn grass. Too coarse a texture detracts from the appearance of turf.

A quite different mixture, giving a much finer-textured turf than the bluegrass mixture first suggested, is 70 per cent Chewing's fescue, 20 per cent Kentucky bluegrass, and 10 per cent Colonial bent. At least 5 pounds of this mixture should be sown on 1000 square feet, and 6 or 7 pounds is better. This mixture is also excellent for shady spots, as Chewing's fescue is perhaps the best all-around grass for shade. It is also quite drouth resistant after it is once established, and the above mixture is satisfactory for terrace slopes.

Poa trivialis, or rough-stalked meadow grass, is also a fairly good shade grass, and may be used in mixtures with an equal weight of Kentucky bluegrass. However, it is much more likely to

be killed out by heat and drouth than is Chewing's fescue. The use of the bent grasses for lawns is discussed on pages 21 to 24.

Obtain High Quality Seed.—Since to the untrained eye all grass seed looks more or less alike, many low-grade or even worthless lawn mixtures are on the market. For the home-owner, the best rule is to buy lawn seed from a seedsman who has a reputation to maintain for seeds, rather than from the local grocery or general store, the proprietor of which usually knows no more about the seeds he sells than does the purchaser himself. Don't try to get something for nothing; in buying grass seed that policy will only



10 lbs. per bushel 15 lbs. per bushel 25 lbs. per bushel

Fig. 4.—Importance of good seed. Bluegrass seed of different weights per bushel, sown at the rate of 4 lbs. per 1000 square feet.

result in getting nothing for something. Read the labels; avoid all mixtures which include Canada bluegrass or orchard grass, and which contain more than one-half of 1 per cent of weed seeds.

Time of Sowing.—Fall seeding of lawn grass is much to be preferred to spring seeding. September is the most favorable month, but seeding in October is far better than waiting until spring, in the majority of seasons, especially in the southern half of the state. If seeding must be delayed until spring, it should be done as early as possible—March, if the ground can be prepared; at least early in April.

Lawn grasses grow poorly in the hot dry summers common to Ohio, and the more growth they can make before hot weather sets

in, the better. A new seeding should be *kept moist* for at least three to four weeks. The difficulty of doing this in late spring and early summer is a good reason for avoiding that season for seeding the lawn.

Sowing the Seed.—To obtain even distribution of seed, the lawn area should be divided into strips 5 to 10 feet wide, and the correct amount of seed for each strip weighed or measured out. It is very desirable to sow half the seed one way and half the other. Sow carefully, when there is no wind. Even distribution of seed is the prime requisite of lawn seeding.

When possible, covering the seed with ¼ inch of ground peat is very desirable. When this is not feasible, rake the seed in lightly. If the soil is dry, roll *lightly* to firm the seed into the soil to insure quick germination.

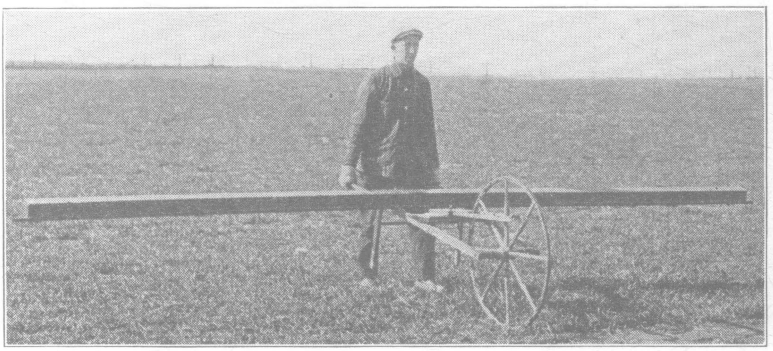


Fig. 5.—The wheelbarrow seeder is useful in seeding large areas.

On large areas, covering the seed with ground peat or by hand-raking is impracticable. In such case covering may be done by dragging a brush harrow over the ground. Such a harrow may be made by binding long spreading branches of brush together to form a sort of "drag" from 6 to 10 feet wide, and so arranged that it can be pulled by a horse.

A very satisfactory method of covering the seed is to sow it on ground which has previously been gone over with a cultipacker, and then allow nature to do the covering. Ground which has been "cultipacked" is firm, free from large clods, and is serrated with alternate small ridges and depressions. On sowing the seed, a part of it will lodge in the slight depressions, and will be covered with soil by the first rain. Enough seed will remain on the ridges to prevent the grass coming up in definite rows.

Maintenance of Turf

To keep a lawn in good condition requires continued care and attention. A lawn originally well constructed will be easier to keep in good condition than one in which poor methods were used. The best methods of maintenance will not overcome the handicaps of poor construction, nor will good construction alone suffice to maintain a good turf. Maintenance includes such practices as fertilization, mowing, rolling, watering, the eradication of weeds, the control of fungous diseases and insect and animal pests—in short, any treatment which has for its object the improvement of the turf.

Fertilization.—The systematic and regular use of the proper fertilizers is essential for the continuance of a satisfactory turf. Fertilizer serves to replace those elements needed by the turf that have been removed in the form of clippings, or have been lost by leaching. Experimental evidence to date indicates that the proper fertilizer for lawns should be a complete fertilizer containing a relatively large amount of nitrogen, and smaller amounts of phosphoric acid and potash.

A mixture containing nitrogen, phosphoric acid, and potash in the ratio 5-3-2 has proved suitable. Commercial complete fertilizers containing the three constituents in this ratio, or approximating it, have analyses such as 10-6-4, 12-8-6 or 8-5-3. Such complete fertilizers are usually mixtures of three or more fertilizing materials, as for instance, sulfate of ammonia, superphosphate, and muriate of potash.

Usually more than half of the nitrogen contained in a complete fertilizer is in inorganic form, and hence is soluble and readily available. A part of the nitrogen may be supplied by some high grade organic material, such as cottonseed meal, soybean meal, or tankage. Nitrogen in these forms is not so active as is nitrogen in inorganic materials. These organic materials contain some phosphoric acid and potash, and under certain conditions may be used alone on turf. The frequency and rate of application of any of the above materials will depend to some extent upon their content of soluble nitrogen.

The greater the quantity of soluble nitrogen in the fertilizer, the more frequent should be the applications, and the less should be the quantity applied each time. The organic materials may be applied in relatively large quantities and a less number of times during the season. In general, applications of such fertilizers as a 10-6-4 should be made at the rate of 5 pounds per 1000 square feet every four to five weeks during the season, beginning about the

middle of April. The last application should be made early in September.

If it is desired to use cottonseed meal or soybean meal, they should be applied in two applications at the rate of 15 to 20 pounds per 1000 square feet each time, the first in early spring, and the second during the latter part of June. An application of 4-12-4 or similar analysis early in September is desirable when cottonseed meal or soybean meal is used.

Any fertilizer should be applied when the grass is dry—free from dew or rain—and then thoroughly watered in, otherwise it may burn the grass. Even distribution is essential. One of the methods described on page 6 should be used for distributing the fertilizer.

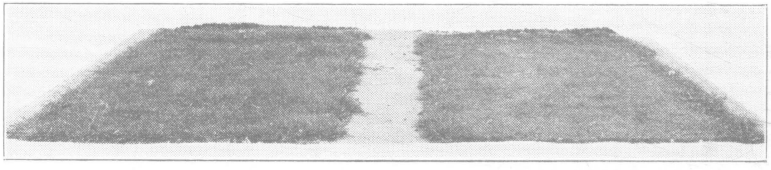
Compost.—The maintenance of a lawn is facilitated by having always on hand a supply of rich compost to use as a top dressing for a reseeding, or for filling in depressions on the lawn. Compost also aids in fertilizing the turf. Almost any organic material will make good compost, if rightly treated. Leaves, grass clippings, garden refuse, or manure may be piled up in one corner of the garden, in a flat pile. When a pile of sufficient size has accumulated it should be built up in alternate layers about 6 inches thick with a good surface soil. The completed pile should be flat on top so as to allow rain water to soak down through it.

Decomposition of the material may be hastened by adding to each layer, at the time the pile is built, some 10-6-4 or fertilizer of similar analysis or a 4-12-4 fertilizer to which has been added an equal weight of sulfate of ammonia. Eight to ten pounds of the fertilizer to each layer of a compost pile 5 by 10 feet in area is sufficient. The addition of 2 to 3 pounds of ground limestone to each layer will also help to hasten the decomposition. If the pile is kept moist and mixed once or twice during the season, the compost should be in a suitable condition for use during the following year.

Mowing the Lawn.—The lawn should be mowed frequently enough so that the clippings can remain without injuring the appearance or the growth of the grass. If the lawn is mowed this often, the clippings will make a mulch on the ground and available plant food will be liberated in their decay, which results in a distinctly better growth of grass than if the clippings are removed. Of course, if the lawn is neglected for even a short time in good growing weather, the clippings will mat after drying and it will be necessary to remove them. If the lawn is shady, the clippings, if allowed to remain, may cause a mouldy condition in damp weather, and generally should be removed.

The height at which the lawn is cut is important. Bluegrass is only moderately well adapted to close mowing. Many have the idea that it benefits grass to mow it. On the contrary, the only reason that grass is mowed to improve its appearance. Mowing is always more or less of an injury to the grass, and the problem is to mow it so as to cause the least injury consistent with maintaining the desired appearance. The shorter a lawn is cut, the more care will be needed in watering, fertilizing, and weed control to keep it in good condition.

For the average lawn, especially after the first of June, the lawn mower should be set as high as it is possible to set the ordinary mower. If the grass is not to be watered regularly, one should be careful not to mow too frequently after the first of June. Bluegrass tends to become almost dormant from the middle of June to the middle of August in an ordinary season. If it is allowed to go into this dormant period with a considerable cover, weed seedlings



Clippings not removed Clippings removed

Fig. 6.—Allowing the clippings to remain on the lawn makes better turf.

will not have as good an opportunity to establish themselves as if the lawn were kept scalped.

In large areas that are regularly mowed by power mowers, it is rather noticeable that there is much better grass in slight depressions where the grass has been left long than in the main body of the turf. The less mowing that can be given a lawn and maintain a satisfactory appearance, the better for the grass. The weak lawn will also be benefited by allowing it to go into the winter with a growth an inch or two taller than the usual lawn length.

Watering the Lawn.—Water when the grass shows definite signs of lacking moisture, and then apply enough to wet the ground at least 4 inches deep. Just how much injury is done by the frequent light "sprinklings" which many lawns receive is debatable, but at least the program above is more economical of water and time. Contrary to a prevalent impression, grass is not injured by watering while the sun is shining. There is no experimental evidence to justify the erroneous impression.

Rolling the Lawn.—A lawn should be rolled just once a year, when the soil has first become dry enough to work after the frost has gone out of the ground. The proper condition for rolling usually lasts only a day or two. The soil should be moist enough to permit the grass to be pushed back into the soil, giving the lawn a smoother surface for the rest of the year, and reducing the loss from drying out of plants loosened by the winter. After this, no more rolling until next year.

Mulching the Lawn.—Many questions are raised about the value of mulching the lawn during the winter with various materials, especially leaves, straw, and manure. There is no indication that grass is benefited in any way by a mulch except by the very slight amount of fertilizing materials which may leach from it. Leaves are definitely injurious, and should be removed in the fall. Manure is a fair fertilizer, but is so unsightly and unpleasant as to have no proper place in lawn care, since equivalent fertilizing value can readily be obtained from chemical sources and manure is apt to introduce a great many weeds. Straw is of no value as a winter mulch.

Rejuvenation of Poor Lawns

It is impractical to attempt to rejuvenate a poor turf that is caused by an extremely heavy, poorly drained soil. Such lawns should be entirely rebuilt, as described in the first part of this bulletin. The thin, unthrifty, weedy condition of many lawns is the result of improper maintenance in the past, and usually indicates an impoverished soil.

If the soil on such lawns is not too heavy and poorly drained, they can be rejuvenated without a complete rebuilding. It should be understood that this cannot be done in a few weeks. Several years may be required for the establishment of a satisfactory turf on such lawns.

The renovation of many poor lawns may be accomplished by the use of fertilizers alone, but in some instances, reseeding and the use of special methods for the eradication of weeds may be necessary. If there is a fair distribution of grass over the lawn, without many weeds, it is possible to develop a good turf by regular fertilization, mowing, and watering as described under "Maintenance of Turf," page 11. If the soil is distinctly impoverished, a basic application of a 4-12-4 fertilizer at the rate of about 20 pounds per 1000 square feet should be made early in the fall. On the bare spots in the lawn the fertilizer should be worked into the soil and the spots reseeded with a good lawn mixture a week or two later.

Eradicating Lawn Weeds

No problem in lawn culture is more universal than that of weed eradication. To a considerable extent this is due to the unnatural condition of very short growth which it is attempted to maintain in a lawn. Before discussing the eradication of particular weeds, it should be emphasized that the first requirements for keeping weeds out of a lawn are proper fertilizing and mowing. No amount of fertilizer or other treatment will keep weeds out of a bluegrass lawn which is mowed too frequently and too closely. It is also useless to try to eradicate weeds where the bluegrass is making so feeble a growth that it does not occupy the ground. Many people

Not sprayed Sprayed once in the spring

Fig. 7.—Spraying with iron sulfate controls dandelions.

say, "I will get rid of the weeds first and then fertilize the grass." If there is grass present the order should be reversed. Fertilize to get a good growth of grass, and then take such steps as may be necessary to prevent the weeds competing with the grass. Unless these two things are attended to, no special weed-control treatment will be of much value.

Where an area is almost entirely occupied by weeds, hoeing them for a month or two, preparing a good seedbed, fertilizing and reseeding in the fall will be the quickest way to obtain a good lawn.

Dandelions.—The dandelion is the most universally distributed lawn weed in Ohio, and perhaps the most difficult to control. No one treatment will give complete control under all conditions. The dandelion has a long tap root which is used for the storage of

reserve food materials. Unlike most plants, it can send out new sprouts from the root, and will sprout again from any part of the root which is in the ground. Hence, cutting a dandelion with a knife results in a circle of new sprouts from the root, even though it is cut far below the crown. However, if the cutting is repeated often enough, the reserve materials in the root will be exhausted and the plant will be killed, so that frequent cuttings, if sufficiently persisted in, will eradicate dandelions from a lawn which grows sufficient bluegrass to occupy the spaces vacated by the dandelions. Dandelion seedlings start in early June and cannot establish themselves readily in a thick growth of bluegrass, so that maintenance of this growth is essential to dandelion control.

Where a uniform stand of dandelions is established in a lawn, spraying with iron sulfate is a satisfactory means of reducing their number. Iron sulfate, or copperas, is used dissolved in water at the rate of 1½ pounds to the gallon, applying 1 gallon to 300 square feet. It may be applied with any sprayer which makes a fine, misty spray. This spray will kill the leaves of the dandelions and not materially injure the bluegrass. The dandelions will send out new leaves at once and the treatment should be repeated every ten days or two weeks. The first treatment should be applied just before the dandelions come into bloom in the spring. About three treatments may usually be given in the spring; in the fall, if there are still large numbers of dandelions, two more treatments should be given before frost.

Iron sulfate should not be used during hot or dry weather. The solution makes rusty stains on stone or cement work and should be kept away from walks or foundations. It will kill white clover as well as dandelions, plantain, and most broad-leaved weeds. It is of no value unless accompanied by proper fertilization. Some very successful applications of iron sulfate have been made dry. If applied dry, the powdered calcined iron sulfate, rather than the coarse crystalline salt, should be used. Five pounds of it are intimately mixed with 2 to 3 pounds of sulfate of ammonia and about 12 pounds of fine dry sand or soil, and spread over 1000 square feet of lawn area when the grass is dry.

If the dandelions are not so numerous as to make it impractical, the application of commercial concentrated sulfuric acid to the center of each plant with an ice pick or other implement may give good results. The application of gasoline to the center of the plant is also satisfactory. Another good method is to put a liberal pinch of sulfate of ammonia on the crown of each plant. Sulfate of ammonia has the advantage of being caustic in high concentrations

but a fertilizer in low concentrations, so that it first kills the weed and then encourages growth of the grass to fill the hole. However, dandelion roots may sprout after any of these treatments.

Plantains.—The lance-leaf plantain or buckhorn and the common broad-leaved plantain are both very common lawn weeds. However, they are not as hard to eradicate as dandelions because they are more shallow rooted, and if they are cut below the crown, do not sprout as dandelions do. The iron sulfate treatment outlined for dandelions will also eradicate plantains, but hand digging is much more feasible because when it is done once it is done for the last time. "Spotting" with dry sulfate of ammonia—that is, putting a liberal pinch of the fertilizer on the crown of each plant, is also effective.

Crab Grass.—Second only to the dandelion in its troublesomeness as a lawn weed is crab grass, also known by many other names. Crab grass is an annual grass and troubles the lawn owner from about July 15 until frost. It likes hot weather as much as bluegrass dislikes it, and usually establishes itself during the period when the bluegrass is dormant. Then when rains come, it is ready to make a very rapid growth, crowding the bluegrass severely. It runs along the ground, taking root at every joint and sending up new shoots from these rooted joints, so that a single plant may cover two or three square feet. The seed heads are long, slender, and joined like the fingers of the hand, so that it is sometimes called finger grass.

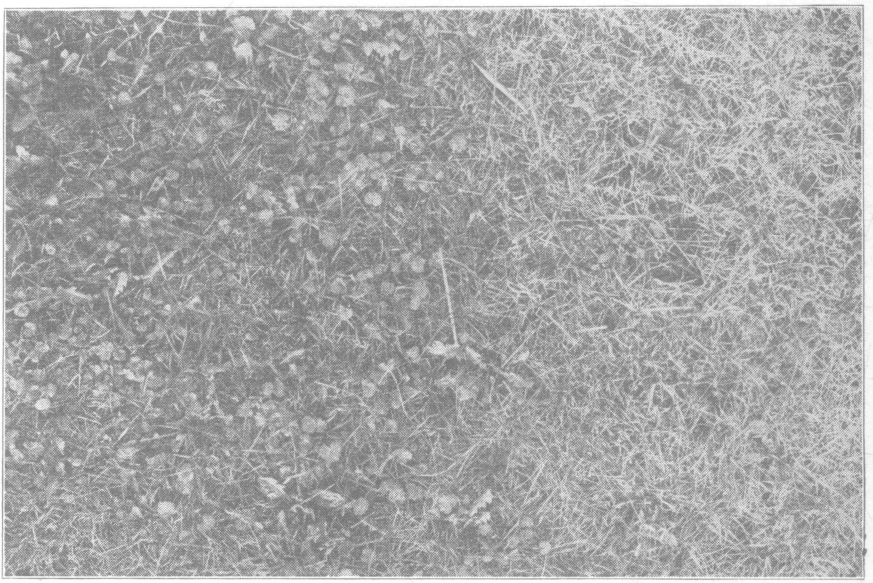
When crab grass is once well established, there is little that can be done to eradicate it. Perhaps the most effective practice is to use a strong steel rake after mowing the lawn, to rake up as many of these runners as possible and then mow it again. This treatment may have to be repeated. Prevention is far more important than cure. Crab grass seedlings start in June, and if there is a dense stand of bluegrass at that time the seedlings will be killed by the shade. Crab grass is very sensitive to shade, seldom being found in the shade of a building or a tree.

Where the stand of grass is not sufficient to kill out the seedlings, a little hand weeding in June and early July when the grass is starting will accomplish more than hours of work will later.

Ground Ivy, Chickweeds, Speedwell, Heal-all, and Moneywort.—These weeds are rather common in lawns and are quite similar in their effects and treatment. They all creep along the ground, root at the joints, and compete seriously with the grass, since they are able to endure as much mowing as the grass. These weeds are very susceptible to chlorates and can readily be eradicated by a spray of 1 ounce of sodium chlorate or 1½ ounces of "Atlacide" or "Vege-

cide" to the gallon, and applied at the rate of 6 to 8 gallons to 1000 square feet. Since there is considerable fire hazard from spilling sodium chlorate, it is probable that the commercial preparations are preferable for lawn use. The chlorates at this strength will not seriously injure grass. Two or more sprays may be necessary, especially for moneywort and mouse-ear chickweed.

If sodium chlorate is used, it should be kept in a tight metal or glass container and especial care taken not to spill the chemical or its solution on the floor or on anything burnable. The solution should be made up outdoors, and care taken to keep it off shoes and other clothing. Pure sodium chlorate is not inflammable, but if it



Unsprayed area Sprayed and reseeded

Fig. 8.—Spraying with sodium chlorate kills ground ivy.

is mixed with anything that will burn, it makes it burn very rapidly after drying.

Moss.—Many persons think of moss as a weed; it is not, in the sense that it is in any way able to compete with or injure the grass. Moss in a lawn is merely evidence that some condition or conditions are preventing the growth of grass. If these are remedied, the grass will grow and the moss disappear. The presence of moss usually indicates a poor soil, a lack of drainage, and too much shade. These conditions can be remedied as previously described. Moss is *not* an indication of a lack of lime.

Lawn Pests

Occasionally lawns are damaged by such pests as grubs, earthworms, sod web worms, ants, and moles. The bent grasses are frequently injured by fungous diseases.

Grubs and Earthworms.—One of the easiest methods of controlling these pests is by the use of lead arsenate. Five pounds of this material is mixed with about a bushel of dry sand or soil, and the mixture spread over 1000 square feet of lawn. The application should preferably be made early in the spring. It may be necessary to repeat the application every year.

Sod Web Worms.—A very serious attack of sod web worms occurred rather generally over the central west during the mid-

Fig. 9.—Destruction of turf by sod web worm.

summer in 1931. In many cases entire lawns were destroyed in a week. These worms are the caterpillars of small whitish moth millers often seen flying about in the summer. The moths lay their eggs on the grass blades. In a few days the eggs hatch into small worms which begin to feed on the grass, cutting it off just at or immediately underneath the surface of the ground. As they grow, the worms make small silken webs into which they retreat when not feeding. The worms when full grown are from ½ to ¾ inch long, and are dark brown in color.

The presence of web worms in a lawn is indicated by the appearance of small brown patches of dead grass which become larger until at times the grass over the entire lawn looks dead. The

web worms may be found hidden in their webs among the grass roots.

Control measures must be commenced immediately or serious damage may occur. Either arsenate of lead or pyrethrum extract may be used. Arsenate of lead is much the cheaper. Applications of 7 to 8 pounds of this material per 1000 square feet of lawn have proved effective. It may be applied mixed with dry sand or soil, or it may be dusted on by putting it in a coarse burlap bag and then vigorously jerking the bag up and down. The material must be evenly distributed. Afterward, it should be worked into the turf by brushing with a coarse broom, then washed down to the soil with a heavy, coarse stream of water from a hose.

Pyrethrum extracts are for sale under trade names. About ¼ ounce of the extract is put in a gallon of water and this applied to a square yard of turf with a sprinkling can. The worms will come to the surface, where some of them die. Some may not be killed but may afterwards crawl into the grass.

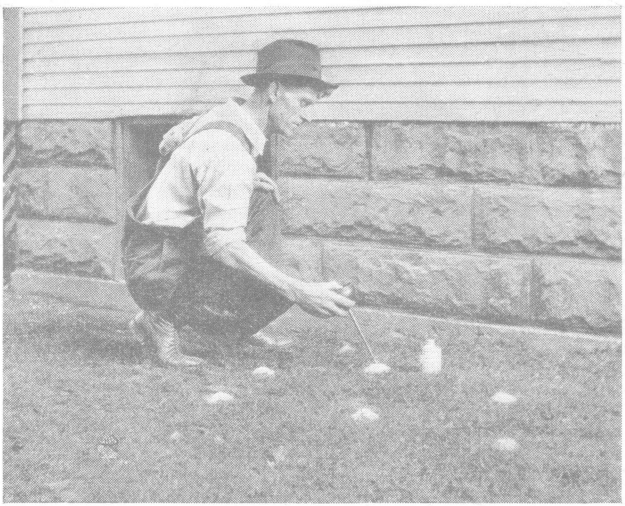


Fig. 10.—Treating nests of ants with carbon bisulfide. An oil can is useful in forcing the liquid into the nests.

Ants.—These may be destroyed by putting about a teaspoonful of carbon bisulfide in each hill with an oil can, and then covering with a damp newspaper for several hours to keep in the fumes. Carbon bisulfide volatilizes into a gas which is both poisonous and very inflammable. It should be used only out of doors and should be kept away from fire.

Moles.—Moles may be destroyed by either poison, traps, or asphyxiation. Several types of mole traps are on the market. They are set so as to catch the mole as it travels through the underground runway. Moles may be poisoned by placing calcium cyanide in the runways at 5-foot intervals. The openings should afterwards be closed but not tramped down. Calcium cyanide is a strong poison and should be handled as such. Moles may be asphyxiated with the exhaust gases from an automobile. Attach a garden hose to the end of the exhaust pipe; insert the other end of the hose in the runway and allow the motor to run for 20 minutes. Any openings in the runway should be closed before the gassing is begun.

The ridge over the runways should be pressed down after the moles have been killed.

Bent Lawns

Many people see the beautiful turf produced by bent on golf greens, and wish for the same turf on a lawn. If the home owner will give his lawn the same amount of intelligent care and attention that the greenkeeper does his greens, he can have the same turf, but few home owners are in position to do this. Bent should not be used on the home lawn except by one who has full knowledge of its requirements. Compared with bluegrass or fescue, it is much more susceptible to turf diseases, requires more frequent and closer mowing, frequent top-dressing, and more careful fertilization and watering. Bent turf may be produced from seed or from stolons.

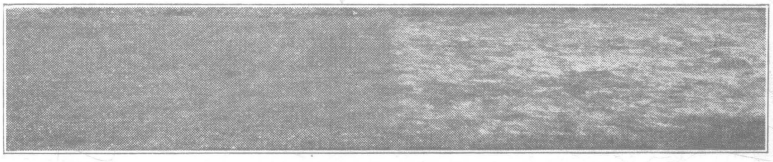
Bent Lawns from Seed.—Of the many known varieties of seeded bents, only a few produce a turf satisfactory for lawns. These include Colonial bent (often called Rhode Island and Prince Edward Island bent), Velvet bent, and Creeping or Seaside bent. Seaside bent is also sold under the trade name of Cocoos bent. These are all distinct species. In addition to the seed of these individual species there are on the market mixtures of two or more of them. One of the best known of these is South German mixed bent.

Colonial bent spreads by means of *under* ground stalks, just as does Kentucky bluegrass. Velvet and creeping bent spread by means of *over* ground creeping stems or runners. Colonial bent does not form as matted or compact a sod as do the creeping bents, and is less exacting in its requirements than are the true creeping bents. Turf produced from mixed seed will be variegated in color and texture because of the different species of bent in the mixture.

The best time to seed bent grasses is in early fall. Careful preparation of the seedbed is essential. At least 3 and preferably 4 pounds of seed should be sown per 1000 square feet.

The Stolon Method.—Stolons are the chopped roots and runners of certain strains of creeping velvet bent. The runners of these grasses are jointed at short intervals, and if kept in contact with moist soil. these joints or nodes send out rootlets that soon develop into new plants. A turf can be produced in much less time by sowing stolons than by sowing seed.

A number of different strains of creeping and velvet bent, developed by the vegetative or stolon method, are commercially available. These are designated by a name usually indicating the locality of their origin. Some of the best known strains of creeping bent are the Washington, Metropolitan, Columbia, and Virginia. Examples of strains of velvet bent that have been developed vegetatively are the Capitol and Highland. No seed of any of these strains is commercially available. In fact, turf produced from seed of vegetative bents is not true to type, hence all of these named



Creeping bent clipped frequently and closely. Clipped weekly and at average lawn height.

Fig. 11.—Lawns of creeping bent need close and frequent mowing.

strains must be developed by the vegetative method. Of the many strains of bents developed in this way, the Washington and the Metropolitan are probably best adapted for use on lawns. Stolons of the velvet bents are much slower to spread than are those of the creeping bents.

Planting the Stolons.—These may be planted at any time during the growing season, if abundant water is constantly available. However, midsummer plantings are not generally so successful as are plantings made in early fall.

The soil, previous to planting, should be worked into a fine, mellow, firm seedbed, and should receive a 4-12-4 fertilizer at the rate of 20 pounds per 1000 square feet. This should be uniformly mixed with the upper 3 to 4 inches of soil. A supply of compost or good top soil should be available for covering the stolons. A satisfactory top dressing consists of one-third by volume of rich compost, one-third of top soil, not too clayey in nature, and one-third sharp sand. Whatever material is used should not cake and harden when it dries out, and should be fine enough to pass a ¼-inch mesh

screen. About 1 cubic yard of top dressing will be required for each 1000 square feet of lawn.

Stolons should be planted as soon as possible after they are cut. Delay lowers their vitality. They are scattered evenly over the seedbed at the rate of about 1 bushel to every 100 to 150 square feet of area. The ground should then be rolled lightly to press the stolons into the soil. The top dressing should then be evenly spread over them to a depth of about ¼ inch. The area should afterward be lightly rolled and watered at once. The water should be applied as a fine spray and should be sufficient to moisten the soil to a depth of at least 4 inches.

For a period of at least three or four weeks after planting, or until the stolons have become well rooted, the surface soil should never be allowed to dry out. Frequent light applications of water should be made at close intervals. During warm sunshiny weather, it may be necessary to water as often as two or three times per day. This is very important, because if the surface soil is allowed to dry out many of the young plants will die.

When the turf has reached a height of about 2 inches it should be mowed, and the clippings allowed to remain. The mower should be sharp so that the young plants are not pulled out by the roots. After the turf has been cut two to four times at a height of 1 inch, the mower is set to cut at about ⅜ to ½ inch. A special "putting green" mower is best adapted for cutting either stolonized or seeded bents. Following the first few mowings, the turf should be lightly top dressed with the compost mixture in order to hasten the development of roots on the runners, and to produce a smooth level surface. The top dressing should be lightly brushed into the turf.

Maintenance of Bent Lawns.—If the bent is to be satisfactory, it must be mowed frequently—at least every other day during the growing season; it must be mowed closely—never higher than ½ inch; it must be top dressed at least three times during the season, and oftener if possible; it should receive frequent and light applications of complete fertilizer. Many golf greens are fertilized every two weeks or oftener, about 1 pound of a fertilizer such as a 10-6-4 being used per 1000 square feet each time. Finally, almost daily watering is essential during dry weather.

Brown Patch.—Bent turf is frequently subject to damage by fungous diseases. The most common of these is called brown patch. Two kinds of brown patch, large and small, or dollar brown patch, are recognized. Both of them develop during periods of hot humid weather, and may quickly cause serious damage on bent lawns. The

first evidence of the presence of brown patch is a fine cobweb-like growth on the grass, most noticeable early in the morning when the grass is covered with dew. Afterwards the grass appears as if scalded, and finally the blades become shriveled, brown, and dead. With large brown patch, the areas are roughly circular, and a foot or more in diameter. In the case of small or dollar brown patch, the areas are small, about the size of a silver dollar, hence the name. Not all browning of the grass is due to brown patch, but if brown spots appear on the lawn almost overnight, the cause should be determined, and if due to brown patch, remedial measures begun at once.

If the attack is just starting, as indicated by the cobweb-like growth on the grass, the damage may be much lessened by "brushing" the turf with a long flexible bamboo pole. This dislodges the fungus from the grass blades. In fact, daily early-morning "poling" of bent turf will lessen the number of attacks of brown patch.

If the disease has advanced to the point where poling is not effective, fungicides must be used. Any one of several compounds of mercury may be used, such as bichloride of mercury and calomel. Several effective commercial fungicides are on the market.

If bichloride of mercury is used, 1 ounce should be dissolved in about 10 gallons of water and this *sprayed* on 1000 square feet of turf.

If calomel is used, 3 ounces are suspended in water, and the suspension sprayed on 1000 square feet of turf.

Either of these two compounds may be applied dry if they are previously mixed with dry sand or screened soil and then broadcast over the affected area.

If a commercial material is used, it should be applied according to the directions on the package.

TESTING LAWN SOILS

Sometimes laboratory tests may aid in diagnosing turf troubles, and in prescribing the remedy. The Department of Soils of the Ohio State University will test soil samples, and offer suggestions for the improvement of lawns.

If such tests are to be of value, the soil sample must truly represent the area concerned. A sample taken from only one spot will not suffice. It should consist of an intimate mixture of at least six separate portions of soil taken from different parts of the area, to a depth of from 3 to 4 inches. At least a pint of this mixture should be sent in for testing.

The tests usually made do not include a detailed chemical analysis, since such an analysis is of little value in predicting the kind or amount of fertilizer needed.